

Appl. No. 10/605,968
Amdt. dated June 13, 2007
Reply to Office action of March 19, 2007

Amendments to the Drawings:

The attached sheets of drawings include changes to Figs. 4 and 6. These sheets, which include Fig. 4 and 6, replace the previously amended sheets including
5 Figs. 4 and 6, and the previously added referral numbers 111, 112, 113 and 211, 212, 213 have been removed, respectively.

Attachment: Replacement Sheet

2 pages

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REMARKS/ARGUMENTS

1. Objection to the drawings:

The replacement drawings, Figs. 4 and 6, filed December 8, 2006 are objected to because the reference numerals 111, 113, 211, and 213 were not in the original specification.

Response:

The drawings, Figs. 4 and 6, have been amended to remove the reference numerals 111, 112, 113, 211, 212, and 213 added in the previous amendment filed on December 8, 2006, although the applicant's opinion is that the previous amendment was made based on the disclosure of the original drawings. The drawings have been restored to their original form. Therefore, reconsideration of the drawings is respectfully requested.

2. Objection to the specification:

The amendment filed December 8, 2006 is objected to under 35 U.S.C. 132(a) because it introduces new matter into the disclosure, for reasons of record.

Response:

The paragraphs [0022] and [0030] have been amended to remove the limitations added in the amendment filed on December 8, 2006, although the applicant's opinion is that the previous amendment was made based on the disclosure of the drawings, Figs. 4 and 6, and the description of "Each of the transparent main features 102 is surrounded by the first phase shift transparent regions 104 and the second phase shift transparent regions 106 *interlaced contiguously* along a periphery of the transparent main feature 102, ..." in paragraph [0022] and "Each of the transparent main features 202 is surrounded by the first phase shift transparent regions 204 and the second phase shift transparent regions 206 *interlaced contiguously* along a periphery of the transparent main feature 202" in paragraph [0030] and still in the

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scope of the instant application. The currently amended paragraphs [0022] and [0030] have been restored to their original form. Therefore, reconsideration of the specification is respectfully requested.

5 3. Rejection of claims 1-20 under 35 U.S.C. 112, first paragraph:

Claims 1-20 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement, for reasons of record.

Response:

10 The recitation "any two contiguous first phase shift transparent region and second phase shift transparent region share a common side with one end located at or on the periphery of the transparent main features, and both of the any two contiguous first phase shift transparent region and second phase shift transparent region each have another side adjacent to the common side and located at or on the periphery of the one of the transparent main features" in claims 1 and 13 has been removed, although the
15 applicant's opinion is that the limitation added in the previously amended claims 1 and 13 was based on the disclosure of the drawings and the description of the specification and more specifically defined. Therefore, the objection under 35 U.S.C. 112 should be overcome.

20 4. Rejection of claims 1-2, 4, 7-20 under 35 U.S.C. 103(a):

Claims 1-2, 4, 7-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,388,736 (Smith et al.) in view of U.S. Patent Application Publication No. 2004/0229131 (Lin et al.) for reasons of record.

Response:

25 The reference '131 (now, U.S. patent 7,008,732) and the instant application were commonly owned by United Microelectronics Corp. at the time the invention of the instant application were made. Therefore, according to 35 U.S.C. 103(c), the reference '131 is disqualified from being used in a 103(a)/102(e) rejection of the

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claims of the instant application. A separate signed statement is attached to this reply to formally indicate this fact, although the limitation added in the previous amendment has been removed in the currently amended claims and the reference '131 would be no longer needed for the rejection of the claims.

5 Furthermore, the applicant would like to explain that, in the method according to the instant application, referring to Figs. 4 and 6 as two embodiments, abstract, paragraphs 13, 22, etc., the phase shifting mask used has the features as follows. A plurality of first (104, 204) and a plurality of second (106, 206) phase shift transparent regions are interlaced *contiguously* (accordingly, two adjacent phase shift transparent
10 regions have a common side) and *surround* one transparent main feature (102, 202) *along the periphery* of the transparent main feature (102, 202) (accordingly, *each phase shift transparent region touches* at least one transparent main feature, in such a way that the common side (i.e. the boundary) of every two adjacent first and second
15 phase shift transparent regions has one end located on the periphery of the transparent main feature). Accordingly, in the embodiments as shown in Figs. 4 and 6, all the first and second phase shift transparent regions would be arranged in an orientation to be substantially *perpendicular to the periphery of* the transparent main feature (such that each of the phase shift transparent regions can have a boundary with the main feature), rather than being parallel to the periphery of the transparent main feature
20 (such that only one phase shift transparent region can have a boundary with the main feature).

However, in the reference '131, referring to Figs. 1A and 1B, a photomask pattern formed on a substrate is disclosed, which comprises: a main pattern (102); and at least a sub-resolution assistant feature located on the sides of the main pattern,
25 wherein each sub-resolution assistant feature furthermore comprises: *a first assistant feature (106a) close to the main pattern (102)*, wherein the phase difference between the first assistant feature (106a) and the main pattern (102) is 180 degree; and a second assistant feature (106b) *further away from the main pattern (102) but adjacent to the*

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first assistant feature (106a), wherein the phase difference between the second assistant feature (106b) and the first assistant feature (106a) is 180 degree. In view of the disclosure, it can be understood that the first assistant feature (106a), and only this assistant feature, is close to the main pattern (102), while the second assistant feature (106b) is away from the main pattern (102). The other first and second assistant features are away from the main pattern (102), too. With an extremely example, the first and second assistant features may be arranged in an orientation to be substantially parallel to the periphery of the main pattern (102). Therefore, the reference '131 discloses a mask having a sub-resolution assistant feature having two kinds of assistant features interlaced contiguously while with a different layout from that of the instant application. The invention of the instant application is not obvious in view of the reference '131.

Claims 1 and 13 are currently amended to include the limitation that "the first phase shift transparent regions and the second phase shift transparent regions along the periphery have a boundary with each other and a boundary with the transparent main feature", and thus the description of the claims are more specific, leading to a clearer scope without controversy. The amendment clearly excludes the situations that the first and second phase shift transparent regions are parallel with the periphery of the transparent main feature and that the first and second phase shift transparent regions are not adjacent to the transparent main feature. The amendment is based on the recitation that "at the *boundary* of the transparent main features 102 and the contrast enhanced features, which are the second phase shift transparent regions 106 having a phase shift of 180 degrees relative to the transparent main features 102," in paragraph [0025], "at the *boundary* of the transparent main features 202 and the contrast enhanced features, which are the second phase shift transparent regions 206," in paragraph [0032], the description "Each transparent main feature is surrounded by the first phase shift transparent regions and the second phase shift transparent regions interlaced contiguously along a periphery of the transparent main feature" in many

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paragraphs of the specification, and Figs. 4 and 6. Thus the currently amended claims 1 and 13 are easily distinguished from the reference '131.

With respect to Examiner's response to arguments, the applicants read with cautiousness the disclosure of Smith et al. in col. 4, lines 3-10, *"The areas* are arranged at locations on the two orientation axes of the lithographic patterns and at a separation distance corresponding to the frequency of the fine pattern detail. The mask of the present invention is a **phase shifting mask** which comprises a transparent substrate and a phase shift formed into said substrate by etching the substrate to form fine phase shift features. The phase shift feature boundaries are spaced close together so that the destructive image intensities at the imaging plane for each feature are not individually resolved but instead produce single dark region by the overlap of destructive image intensity from the two boundaries during image formation using the said illumination source." The applicants found that *"The areas"* is the four separate localized areas of *the illumination source* (col. 3 line 67-col.4 line 1), not of a phase shift mask. The method disclosed by Smith et al. combines an off-axis illumination and phase shift masking (col. 3, lines 49-51). With respect to the phase shift masking of Smith et al., although Smith et al. disclose "boundaries (numeral 60 in Figs. 6A-6C) of the phase shift features are placed very close each other such that the destructive image intensities does not resolve but produce a dark region", there is not a disclosure concerning such PSM layout which has *a transparent main feature surrounded by two kinds of phase shifting areas which interlace contiguously along a periphery of the transparent main features and have a boundary with (i.e. touch) each other and a boundary with the transparent main feature.* As Examiner has already realized that, in the phase shift mask of the instant application, a main feature is surrounded by a plurality of two kinds of transparent phase shifting regions and any two adjacent transparent phase shifting regions are substantially touching each other and the main features. After the claim amendment, the layout of the phase shift mask can be easily distinguished from the teaching or disclosure of Smith et al.

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Therefore, Smith et al. did not teach currently amended claims 1 and 13 of the instant application. Claims 1 and 13 should be allowable over Smith et al. and the reference '131. Reconsideration of claims 1 and 13 is hereby respectfully requested.

As claims 2, 4, 7-12 and 14-20 are dependent on claims 1 and 13, respectively,
5 they should be allowed if claims 1 and 13 are allowed. Therefore, reconsideration of claims 2, 4, 7-12 and 14-20 is politely requested.

5. Rejection of claims 3, 5-6 under 35 U.S.C. 103(a):

Claims 3, 5-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over
10 U.S. Patent No. 6,388,736 (Smith et al.) in view of U.S. Patent Application Publication No. 2004/0229131 (Lin et al.) as applied to claims 1-2, 4, 7-20, and further in view of U.S. Patent Application Publication No. 2004/0013948 (Lin et al.), for reasons of record.

Response:

15 The reference '948 and the instant application were commonly owned by United Microelectronics Corp. at the time the invention of the instant application were made. Therefore, according to 35 U.S.C. 103(c), the reference '948 is disqualified from being used in a 103(a)/102(e) rejection of the claims of the instant application.

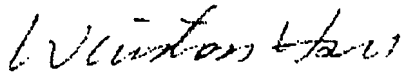
Furthermore, as claims 3, and 5-6 of the instant application are dependent on
20 claim 1, they should be allowed if currently amended claim 1 is allowable. Therefore, reconsideration of claims 3, and 5-6 is hereby respectfully requested.

Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

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Sincerely yours,



Date: 06.13.2007

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